

Self-Supporting High Performance Multi-Layer Insulation Technology Development (SSMLI)

Completed Technology Project (2012 - 2013)



Project Introduction

A new type of MLI—Integrated Multi-Layer Insulation (IMLI)—uses rigid, low-conductivity polymer spacers instead of netting to keep the radiation barriers separated. In addition to making the material stiff enough to support itself and advanced thermal shields, the spacers reduce the amount of heat leak to the tank. This project aims to perform ground testing to validate thermal and structural performance of Integrated Multi-Layer Insulation (IMLI).

IMLI coupons have been outperforming traditional MLI. IMLI has better thermal performance—with some insulating properties improved by up to 37 percent (and analysis indicates that this could grow to 73 percent for a full system). IMLI reduces system uncertainty in thermal performance and lowers fabrication and installation costs. In addition, it has a more durable structure and was not damaged by the high acoustic noise levels associated with launching on a rocket. In 2013, the project conducted two tests with IMLI blankets applied to storage tanks: a thermal test and an acoustic test. The tests will have already been completed with traditional MLI. NASA Glenn conducted the thermal test in its Small, Multi-Purpose Research Facility (SMiRF), which simulates the vacuum and temperature extremes of space. The researchers tested IMLI that is supporting a Broad Area Cooling shield actively cooled by a cryocooler to see if IMLI can be used for the long-duration storage of liquid hydrogen with reduced boil-off. NASA Marshall conducted the acoustic test, subjecting an IMLI blanket and shield identical to those used in the SMiRF tests to the vibrations and noise levels experienced during launch on a rocket. Use of this new insulation system supports NASA's goal to achieve zero boil-off, which would help enable longduration missions as NASA develops new capabilities for human space exploration. On Earth, this superinsulation may one day be used in homes and factories—reducing energy usage and furthering NASA's mission to drive advances in science that benefit everyone.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

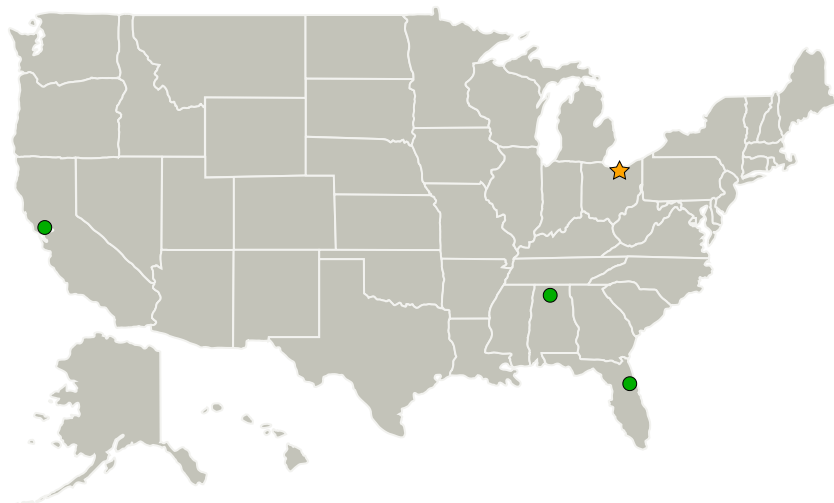
Game Changing Development

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
● Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Project Management

Program Director:

Mary J Werkheiser

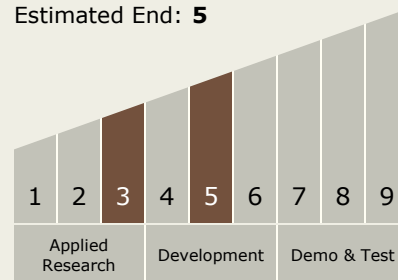
Program Manager:

Gary F Meyering

Project Manager:

Michael P Doherty

Technology Maturity (TRL)

Start: 3
Estimated End: 5

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
 - └ TX13.2 Test and Qualification
 - └ TX13.2.2 Propulsion, Exhaust, and Propellant Management